

AMENDMENTS TO THE DRAWINGS

Please substitute attached Replacement Sheet 7, which includes Figures 7 and 8, for original sheet 7 including Figures 7 and 8. Replacement Sheet 7 attached hereto includes a clean version of original Figure 8 and amended Figure 7. Replacement Sheet 7 amends Figure 7 to change reference numeral “410” to “710” to conform Figure 7 to the description in paragraph 72 of the specification. A marked-up copy of the amended drawing figure is not being included in this electronically filed Response. However, a marked-up copy of the amended drawing figure, including annotations indicating the changes made, will be provided if requested by the Examiner. No new matter is added.

REMARKS

Amendments to Claims

Claims 1-121 were previously pending in this application, of which claims 1, 46, 53, 70, 75, 93, 96, 106, 109 and 114 were independent.

Applicants note with appreciation that the following claims are objected to but deemed to recite allowable subject matter: claim 17; claim 32 and dependent claims 33-39; claim 41 and dependent claim 42; and claim 85 and dependent claims 86-90. Accordingly, claim 1 is amended to include limitations of objected to claim 17 and intervening claim 13; objected to claim 32 is amended to incorporate the limitations of base claim 1 and intervening claims 26, 19 and 13; minor amendment is made to allowed independent claims 53 and 70; and claim 75 is amended to include limitations of dependent objected to claim 85 and intervening claims 83 and 84. Applicants also note with appreciation that claims 53-74 are allowed. Now in the case are claims 1-121, of which claims 1, 32, 41, 53, 70, 75, 93, 96 and 106 are independent.

Amendments other than incorporating intervening and base claims are made to claims. Claims having limitations thereof incorporated into base claims are amended, including amendments to change dependencies. Other amendments that are non-narrowing and/or not related to patentability are made, such as, for example, to improve the readability of claims. For example, in many instances amendments are made to correct typographical errors and/or obvious mistakes that would be apparent to those of ordinary skill in the art in the context of the surrounding language of the claim. In some instances amendment is made to non-limiting language of the preamble to improve readability. No new matter has been added; support for the foregoing amendments is clearly found throughout the specification, including the Figures and the claims. Where appropriate, amendments to particular claims are described in more detail below.

Amendment to the Specification

Amendments are made to the specification to correct minor typographical and grammatical errors, as is generally evident by inspection of the proposed amendments. More particularly, Paragraph 58 is amended to redact a “minus” sign in the second equation. Paragraph 85 is amended to change “Green” lens to “GRIN” lens. One of ordinary skill in the art would understand that the “Green” is a typographical error and the type of lens being referred to in paragraph 85 is a “GRIN” lens, which is a known lens having a graded index of refraction.

Such a lens can be interposed between lengths of fibers to facilitate optical coupling between the fibers. In support of the proposed amendment to paragraph 85, submitted herewith as an Appendix to the Specification are 3 pages from the 1996 Photonics Dictionary published by Laurin Publishing Co., of Pittsfield MA, a well known publisher of journals in the field of optics, such as, for example the trade journal Photonics Spectra. Photonics Dictionary has been cited in at least one patent decision of the Court of Appeals for the Federal Circuit. See, for example, Edwards Systems Technology, Inc. v. Digital Control Systems, Inc., 2004 WL 1153663 (Fed. Cir. 2004). As indicated by the attached pages, Photonics Dictionary includes an entry for “GRIN lens”, but does not include any entry for “Green lens”. Applicants’ attorney is not aware of any type of lens commonly referred to as a “Green” lens. Accordingly, entry of the proposed amendment is respectfully requested.

Rejection of Claims 1-16, 18-31 and 43-45 and Objection to Claim 17

Claims 1-6, 9, 13-16, 18-31 and 43-45 are rejected as anticipated under 35 USC § 102(e) by US Patent No. 6,717,963 to Foursa (“Foursa”). Claims 7-8 and 10-12 are rejected under 35 USC §103 as obvious over Foursa in view of US Patent No. 6,845,202 to Paek et al. (“Paek”).

The Examiner deems claim 17 to recite allowable subject matter. The Examiner notes that claim 17 would be allowable if amended to include limitations of the base claim (claim 1) and any intervening claims (claim 13).

Claim 1 is amended to include limitations of claims 13 and 17 and hence is now allowable. Furthermore, claims 1-31 and 43-45, which depended, directly or indirectly, from amended claim 1, are also now allowable. Allowance of the claims is respectfully requested.

Minor amendment is made to the preambles of the foregoing claims, and in certain instances to the dependencies of the claims, to further improve the readability of and/or clarify the claims. Other amendments are made as well. Claims 13 and 17, limitations of which are incorporated into claim 1, are amended. No new matter is added. Amended claim 13, dependent from claim 3, now recites “...wherein the fiber comprises a Raman laser or amplifier and wherein the fiber further comprises a fourth reflector disposed in the optical fiber between said first and second reflectors, the fourth reflector configured to reflect substantially all energy impinging thereon at the second wavelength”. Regarding claim 13, see, for example, original claims 19-23 and Figure 1 and the accompanying description thereof in the specification as filed. Amended claim 17, dependent from claim 13, now recites that “a length of fiber of the first

section having the first active material and a length of fiber of the second section having the second active material are interposed between said first and second reflectors.” Regarding claim 17, see, for example, Figures 1-2, 5-14 and the description thereof in the specification as filed. Claim 30 is amended to redact “second” to avoid confusion or unduly limiting claim 30, as amended claim 1 now recites the term “second wavelength”. The foregoing amendments can be considered non-narrowing and/or not related to patentability.

The rejection of the foregoing claims 1-16, 18-31 and 43-45 is not discussed in detail herein. However, Applicants reserve all rights. For example, Applicants do not concede that Foursa or Paek, taken alone or in combination, teach or suggest the limitations of the foregoing claims as indicated by the Examiner in the outstanding Office Action. Accordingly, Applicants reserve the right to refile rejected claims and argue the patentability of thereof in a continuing application. Furthermore, Applicants do not concede that the cited Foursa and Paek documents are prior art, and reserve, for example, the right to swear behind the foregoing references upon determination of appropriate supporting facts. Such reservation also applies to other rejections and characterization of the art not specifically discussed herein.

Objection to Claims 32-39

It is noted with appreciation that the Examiner deems claims 32 and claims 33-39 dependent, directly or indirectly, therefrom to recite allowable subject matter. Claim 32 is amended to incorporate limitations of base claim 1 and intervening claims 13, 19 and 26. Accordingly, claims 32-39 are now allowable. Allowance of claims 32-39 is respectfully requested.

Rejection of Claims 40 and 46-52 and Objection to Claim 41 and Claim 42

Claims 40 and 46-52 are rejected as anticipated under 35 USC § 102(e) by Foursa.

It is noted with appreciation that the Examiner deems claim 41 to recite allowable subject matter, and that claim 41 would be allowable if amended to incorporate the limitations of the base claims and any intervening claims. Claim 41 is amended to incorporate the limitations of the base claim (claim 1). Claims 40, 42 and 46-52, if not previously dependent, directly or indirectly, from claim 41 are amended to now depend, directly or indirectly, from claim 41. Accordingly, it is respectfully submitted that claims 40-42 and 46-52 are now allowable.

Regarding claim 42, it is noted that claim 42 depended on claim 41 when examined for the outstanding Office Action. It is assumed, therefore, that the rejection of claim 42 noted on page 2 of the outstanding Office Action is a mistake, as there is no other discussion of such a rejection in the Office Action and claim 42 is noted as reciting allowable subject matter on page 6 of the outstanding Office Action. Accordingly, allowance of claims 40-42 and 46-52 is respectfully requested.

As noted above, claim 40 is amended to depend from claim 41 instead of claim 1. Other amendments are made to claims 46-52, as is evident from examination of the attached claim amendments. No new matter is added; support can be found throughout the specification, including the drawings and claims as originally filed. Regarding claim 50, see, for example, paragraph 85 of the specification. Regarding claim 52, see, for example, Figures 1-2 and 5-14 and the description thereof in the specification as filed, including paragraphs 73 and 81. The foregoing amendments can be considered not related to patentability and/or non-narrowing.

Allowed Claims 53-74

It is noted with appreciation that the Examiner deems claims 53-74 to be allowable.

Independent claim 53, from which claims 54-69 depend, directly or indirectly, and independent claim 70, from which claims 71-74 depend, directly or indirectly, are amended to redact “spliced” and to insert “coupled”. Claims 53 and 70 are amended as follows: “an optical fiber having a first section and a second section ~~spliced~~coupled to the first section.” This amendment conforms claims 53 and 70 to claim 1, which recites “coupled” and furthermore reconciles claim 53 with claim 66 dependent therefrom, which recites that the first and second sections are “spliced together.” Fiber sections that are “coupled” are arranged such that energy can transfer therebetween (see, for example, paragraph 85 of the specification) and does not require a physical connection, such as a splice. Coupling can be accomplished via optical communication between fibers using, for example, a lens. It is noted that the Examiner’s determination of allowability of claims 50 and 70 does not appear to rely on the recitation of “spliced” in claims 50 or 70.

Similarly, claims 53, 54-55, 61 and 70 are amended to redact certain recitations regarding sections of the fiber in which reflectors are disposed. The Examiner’s determination of allowability does not rely on such recitations and the specification indicates that the invention

does not require reflectors to be disposed in a particular section. See, for example, paragraph 73 of the specification:

While the systems represented in Figs. 1 and 3-7 have shown reflectors and/or suppressor(s) having particular locations within optical fiber **110**, it is to be understood that these components can have different locations (relative locations and/or absolute locations) within fiber **110**. For example, the relative positions of reflectors **170** and **190** can be reversed. As another example, reflector **310** can be located in section **140** of fiber **110**. As an additional example, reflector **180** can be disposed in section **130** of optical fiber **110** (e.g., to the right or left of point **150**), and/or reflectors **170** and **190** can be disposed to the right of section **140** (e.g., in another section of fiber spliced to the right of section **140** of fiber **110**). Combinations of these configurations can be used. Other locations of reflectors and/or suppressor(s) in fiber **110** are also contemplated.

Accordingly, entry of the foregoing amendments is respectfully requested, as well as the minor amendments made to the preambles of claims 53-74. The amendments are non-narrowing and/or not related to patentability and more properly secure to the inventors the scope of their invention.

Rejection of Claims 75-84 and 91-92 and Objection to Claims 85-87 and 89

Claims 75-84 and 91-92 are rejected as anticipated under 35 USC § 102(e) by Foursa.

It is noted with appreciation that the Examiner deems claims 85-87 and 89, dependent, directly or indirectly, from independent claim 75, to recite allowable subject matter. Claim 75 is amended to incorporate limitations of claim 85 and intervening claims 83 and 84.

Claim 75 is also amended to provide better readability regarding the nomenclature used to refer to the various reflectors recited in claim 75. Both prior to the present amendment and as amended, Claim 75 recites "...a plurality of reflectors ... said plurality including two reflectors ...". The present amendment to claim 75 makes it more readily ascertainable that the first reflector of the first section and the first reflector of the N^{th} section recited in the limitations added from claims 83-84 to claim 75 via the present amendment are the "two reflectors" recited earlier in claim 75. Similarly, the "second" reflector recited in claim 85 before the present amendment thereto is now referred to as the "third" reflector in amended claim 75. Claim 75 is also amended to recite that $(N-1)^{\text{th}}$ section creates energy at the wavelength $\lambda_{s1(n-1)}$. The foregoing amendment clarifies the term $\lambda_{s1(n-1)}^{-1}$ in the equation $\lambda_{s1n}^{-1} = \lambda_{s1(n-1)}^{-1} - \lambda_{rn}^{-1}$, recited in claim 75 both before and after amendment. Amendment is also made to claim 75 to clarify that

the first section of the fiber is configured to receive pump energy, which need not be provided to the first section via an end of the fiber (side couplers, such as fused tapered couplers, are well known in the art). No new matter is added; support is found throughout the specification as filed, including the drawings and claims as filed. See, for example, Figures 8-13 and the accompanying description thereof in the specification. Regarding the creation of energy at $\lambda_{\text{sil}(n-1)}$, see paragraphs 86-87. Regarding the use of couplers for providing pump energy to the fiber, see the coupler 1401 shown in Figure 14 and the discussion thereof at paragraph 94. The foregoing amendments can be considered as non-narrowing and/or as not related to patentability.

Claims 83-85, limitations of which are incorporated into amended claim 75, are also amended. No new matter is added; see, for example, paragraphs 73 and 81. Regarding amendments to claims 86-87 and 89, see paragraphs 86-87.

Accordingly, it is respectfully submitted that amended independent claim 75 and claims 76-87 and 89 dependent, directly or indirectly, therefrom are now in condition for allowance.

Objection to Claims 88 and 90

Claims 88 and 90 are amended and now depend from amended independent claim 53, which as noted above recites allowable subject matter. Amended claim 88, in addition to now depending from claim 53, now recites "The optical fiber apparatus of claim 53, wherein fiber of the second section having said second active material is interposed between the third and fourth reflectors and has as first length and wherein if any fiber of the first section having said first active material is interposed between the third and fourth reflectors the length of such fiber is less than the first length." No new matter is added; support is found throughout the specification, including the drawings and claims as originally filed. See, for example, Figures 1-2, 5-14 and the description thereof in the specification as filed, including paragraphs 73 and 81.

Amended claim 90 depends from claim 88 and recites "The optical fiber apparatus of claim 88, wherein a length of fiber of the first section having the first active material and a length of fiber of the second section having the second active material are interposed between said first and second reflectors." No new matter is added. See, for example, Figures 1-2, 5-14 and the description thereof in the specification as filed, including paragraphs 73 and 81.

Claims 93-95

Independent claim 93 and claims 94-95 dependent therefrom are rejected as anticipated under 35 USC § 102(e) by Foursa. As amended, independent claim 93 incorporates the recitations of amended claim 75, which, as noted above, recites allowable subject matter. Accordingly, it is respectfully requested that the rejections of independent claim 93 and claims 94-95 dependent therefrom be withdrawn and the claims be allowed.

Claims 96-105

Claims 96 and claims 97-105 dependent therefrom are rejected as anticipated under 35 USC § 102(e) by Foursa.

Independent claim 96 is directed to a highly efficient Raman fiber laser or amplifier. As recited in claim 96, the Raman fiber laser or amplifier includes “a plurality of reflectors disposed in the optical fiber, the plurality of reflectors being configured so that energy propagating in the optical fiber at the first wavelength undergoes at least one Raman Stokes shift to create energy in the optical fiber at the second wavelength ...” Claim 96 further includes a specific recitation as to the efficiency of the Raman fiber laser or amplifier – the configuration of the reflectors is such that “when the optical fiber receives energy at the first wavelength, ***a power output by the optical fiber at the second wavelength is at least about 55% of a power of the energy the optical fiber receives at that first wavelength.***” The specification at paragraphs 27-28, 56-57 and 91-92 notes the relatively high efficiency of conversion of energy to a desired wavelength, such as by the Raman fiber laser or amplifier as recited in claim 96. The evolution of energy conversion from one wavelength to a desired wavelength according to one aspect of the present invention is shown in Figures 3A-3C and the description thereof in paragraphs 64-68. Foursa, by contrast, is understood to be concerned with reducing ripple in the output of a Raman fiber amplifier, not efficiency; more specifically, Foursa is directed to a Raman fiber amplifier wherein a continuous wave or substantially continuous wave pump source with a flat spectrum allows amplification with substantially no ripple in the amplified signal (Abstract of Foursa). A text search of Foursa using the USPTO website reveals no mention of the term “efficiency” in Foursa.

More particularly as regards claim 96, the Office Action is silent as to the specific recitation noted above that “a power output by the optical fiber at the second wavelength is at least about 55% of a power of the energy the optical fiber receives at that first wavelength”; the

limitation is not addressed at all. The Office Action merely states at page 4 that, regarding claim 96, “Foursa shows all the claimed structural limitations, therefore, it is clear that the claimed characteristic of the device is inherently shown by Foursa’s device.”

Applicants respectfully disagree that the foregoing limitation is inherently met by Foursa. At the outset, Applicants note that the burden is on the Patent Office to establish the inherency in the prior art of each and every one of the claim limitations. To meet this burden, the Examiner must provide a rationale or evidence tending to show inherency. The fact that a certain characteristic may be present in the prior art is not sufficient to establish the inherency of that result or characteristic (see MPEP §2112). The limitation must necessarily be present in the teachings of the reference, such that it would be recognized as such by persons of ordinary skill in the art (MPEP §2112 and §2131.01). Inherency may not be established by mere probabilities or possibilities (MPEP §2112). “In relying upon a theory of inherency, the Examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art” (MPEP §2112 quoting *Ex parte Levy*, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Int. 1990) (emphasis in original quotation)).

The outstanding Office Action fails to meet this burden by failing to provide any reasonable rational or technical reasoning to support the proposition that the limitation “a power output by the optical fiber at the second wavelength is at least about 55% of a power of the energy the optical fiber receives at that first wavelength” necessarily flows from the device taught by Foursa. The Patent Office has not, in the present rejection, established anything close to an adequate basis in fact and/or technical reasoning to reasonably support the assertion that the foregoing limitation recited in Applicants’ rejected claim 96 is inherently anticipated by Foursa as required under the law (see MPEP §2112). Accordingly, Foursa does not disclose or suggest the limitation of claim 96 of a “a power output by the optical fiber at the second wavelength is at least about 55% of a power of the energy the optical fiber receives at that first wavelength”.

Because each of the limitations of independent claim 96 has not been shown by the Patent Office to have been taught or suggested in Foursa, it is respectfully submitted that the rejection cannot stand. Reconsideration and withdrawal of the rejection is respectfully requested.

Furthermore, claim 96 as amended recites “an optical fiber having at least first and second sections” where the first section has “a gain medium with a first active material” and the second section has “a gain medium with a second active material *that is different than the first*

active material.” It is respectfully submitted that Foursa fails to teach or suggest the foregoing limitation.

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. See MPEP §2131, citing Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). For Anticipation “the *identical* invention must be shown in *as complete detail as is contained in the ... claim.*” See MPEP §2131, citing Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989) (emphasis added).

Foursa fails to teach or suggest a second section having gain medium with a second active material that is different than the first active material, as specifically recited in claim 96. The Examiner cites column 4, lines 36-54 of Foursa for the proposition that “Foursa clearly shows ... that the first material could be different from the second material, and could be the same as the second material”. (Office Action, page 3).

The foregoing passage cited by the Examiner describes Figure 5 of Foursa. Figure 5 shows an optical fiber with gratings where the “fiber gratings 1, 2, 3 comprise a laser cavity for the generation of first second and third Stokes wavelengths” (Foursa, column 4, lines 36-37). Foursa subsequently states (column 4, lines 46-51):

The fiber cavities can be formed using silica fibers with the maximum Stokes shift of 440 cm^{-1} or other types of fiber, for instance phosphosilicate fiber with a Stokes shift of 1330 cm^{-1} . The latter has been demonstrated to generate radiation at 1.48 nm at a second Stokes shift from the pump wavelength at 1 nm .

The foregoing passage merely states the conventional fact that a Raman amplifier of Foursa could be made of one of *either* silica fiber *or* phosphosilicate fiber. There is no teaching or suggestion commensurate with the detailed recitation in claim 96, as required by MPEP §2131, of a “second section” having “a gain medium with a second active material that is different than the first active material.” There is no discussion of different sections of fiber having different active materials. Furthermore, Foursa acknowledges that silica fiber and phosphosilicate fiber have different maximum Stokes shifts of 440 cm^{-1} and 1330 cm^{-1} , respectively. If the fiber of Figure 5 were to include a section comprising silica and a section comprising phosphosilicate, each section would be capable of generating its own unique family (i.e., first, second, third etc.) of Stokes wavelengths. Yet Foursa takes no account of this, and does not differentiate which of the gratings 1, 2, 3 reflect at Stokes wavelengths corresponding to

silica and which those corresponding to phosphosilicate, merely stating, as noted above, that “gratings 1, 2 and 3 comprise a laser cavity for generation of first, second and third Stokes wavelengths”. Clearly Foursa merely teaches, as noted above, that the fiber of Figure 5 is either completely phosphosilicate or completely silica. Accordingly, Foursa fails to teach or suggest a limitation recited in amended claim 96 and fails to anticipate claim 96.

While the Applicants do not concede that Foursa teaches the further limitations added by claims 97-105, Applicants note that these claims depend from claim 96 and, thus, are patentable over Foursa for at least the reasons discussed above with regard to claim 96. Allowance of claim 96 and claims 97-105 dependent, directly or indirectly, therefrom is respectfully requested.

Claims 106-121

As amended claims 107-121 now depend, directly or indirectly, from claim 106. Many of the amendments are minor, as discussed above, and do not warrant discussion. Support for all the amendments is found throughout the specification, including the claims and figures as filed. See, for example, Figures 1-2 and 5-14 and the description thereof in the specification as filed, including paragraphs 73 and 81. Amendments are made to clarify the claims and can be considered not related to patentability and/or are non-narrowing. For example, reasoning presented below regarding the failure of Foursa to anticipate claim 106 makes reference to limitations recited by claim 106 as examined for the outstanding Office Action and as amended. Regarding claims 119-121, see paragraphs 46 and 64 of the specification and original claims 7-8, 9-10, 37-39, 56-58 and 62-65.

Claims 106-121 are rejected as anticipated under 35 USC § 102(e) by Foursa. Amended claim 106 is directed to a Raman fiber laser or amplifier having, in addition to other limitations, an optical fiber having a plurality of sections, with “at least two of the plurality of sections having gain media comprising different active materials.” For at least the reasons noted above regarding a similar limitation recited in claim 96, Foursa fails to anticipate claim 106.

Applicants note that claims 107-121 depend, directly or indirectly, from claim 106 and thus Foursa fails to anticipate claims 107-121 for at least the reasons noted above regarding claim 106. Accordingly, additional limitations added by dependent claims 107-121 need not be discussed at this time. No concession that Foursa teaches additional limitations recited in dependent claims is to be inferred.

Allowance of claims 106-121 is respectfully requested.

Request for Two Month Extension of Time

Applicants hereby request an extension of time of two months for response to the outstanding Office Action mailed July 26, 2006, thereby extending the time for response to December 26, 2006.

Electronic Payment of Fees

Fees associated with this filing (Two Month Extension of Time fee of \$225 for a Small Entity) are being paid electronically. No other fees are considered to be due. However, if it is determined that an additional fee is due, or that an overpayment has been made, please debit or credit, as appropriate, Deposit Order Account 50-2343.

CONCLUSION

This Response and Amendment is considered to address all matters raised by the Examiner in the outstanding Office Action mailed July 26, 2006. Applicants respectfully submit that the claims patentably distinguish over the art relied upon. Reconsideration and withdrawal of all rejections and objections is respectfully requested. Please do not hesitate to contact the undersigned if any issues are deemed to remain unresolved.

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Respectfully submitted,

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